

REFERENCES

- CRANDALL, LEE S. (1965) : The Management of Wild Mammals in Captivity. The University of Chicago Press, Chicago and London, pp. 359-413.
- FLOWER, S. S. (1931) : Cited by Crandall, Lee S. (1965).
- JONES, M. L. (1958) : Cited by Crandall, Lee S. (1965).

3. CAUSES OF DEER MORTALITY IN INDIA

In India the information on causes of mortality in deer in free living state or captivity is very meagre. There have been reports of occasional episodes of Rinderpest (Schaller 1967, Srivastava 1957, Singh 1958, Gupta and Verma 1949, Ray and Samanta 1974), tuberculosis (Liston and Soparkar 1924, Basak *et al.* 1976) ; fascioliasis (Rao and Acharjyo 1972) etc. Isolated cases of parasitic infestations and other miscellaneous conditions have also been recorded (Rao and Acharjyo 1972, Rao and Acharjyo 1969, Tripathi *et al.* 1971, Patnaik and Acharjyo 1970, Sen Gupta 1974). This paper records the causes of mortality among various species of deer in Zoological Parks, National Parks, Sanctuaries and reserve forests in different parts of the country.

MATERIALS AND METHODS

In an attempt to determine the relative importance of various diseases to which members of cervidae family are prone to suffer and the causes of mortality, a countrywide survey was conducted. The mortality information for three years period (1975-1977), based on post mortem examinations was obtained from fifteen Zoological Parks (Bhillai, Bombay, Darjeeling, Delhi, Hyderabad, Junagadh, Kanpur, Kohima, Mysore, Pune, Renuka, Shillong, Silvassa, Tutikandi and Visakhapatnam) ; two national parks (Corbett and Shivpuri) ; one Sanctuary (Kinnarsanni) and reserve forests in two states (West Bengal and Jammu and Kashmir). Information on the species of dead animal and

date of death was also collected. Information was sought also on total populations of each species, sex and age at death of each animal, but the provided information was not complete and therefore, could not be used.

RESULTS AND DISCUSSION

During the three year period 1975-1977, a total of 243 deaths had been recorded in eleven species of deer which included 107 Chital (*Axis axis*) ; 29 hog deer (*A. porcinus*) ; 40 barking deer (*Muntiacus muntjak*) ; 4 musk deer (*Moschus moschiferus*) ; 3 fallow deer (*Dama dama*) ; 28 sambar (*Cervus unicolor*) ; 8 thamin (*C. eldi*) ; 2 Kashmir stag (*C. elaphus hanglu*) ; one swamp deer (*C. duvauceli*) ; 14 mouse deer (*Tragulus meminna*) and 7 Sikka deer (*Cervus nippon*). Out of these, Kashmir Stag, Musk deer, Swamp deer and Thamin deer are endangered species and hence have been included in Schedule I of Indian Wildlife Protection Act, 1972. Fallow deer (*Dama dama*) and Sikka deer (*C. nippon*) are exotic species and are being displayed in various Indian Zoos. Sikka deer has also been listed as endangered species. Out of 243, 32 deaths occurred of animals in free living state in national parks, sanctuaries and forests and the remaining among animals in the zoological gardens.

Causes of mortality :

As shown in table 1, tuberculosis was quite a frequent cause of mortality in captive chital,

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TABLE 1
RECORDED CAUSES OF DEATH IN DIFFERENT SPECIES

Causes of death	Spotted deer	Barking deer	Hog deer	Sambar deer	Mouse deer	Sikka deer	Musk deer	Fallow deer	Thamin deer	Kashmir stag	Swamp deer	Total
1. Tuberculosis	16	01	—	—	—	—	—	—	—	—	—	17
2. Anthrax	02	02	—	—	—	01	—	—	—	—	—	05
3. Pasteurellosis	—	—	—	—	—	—	01	—	—	—	—	01
4. John's disease	—	—	—	—	—	—	—	—	—	01	—	01
5. Fascioliasis	12	—	02	—	—	—	—	—	—	01	—	15
6. Pneumonia	13	—	04	04	01	—	02	01	—	—	—	25
7. Gastroenteritis	03	03	—	01	01	02	—	—	—	—	—	10
8. Dystokia	02	01	—	01	03	—	—	—	—	—	—	07
9. General debility and anaemia	06	01	04	06	02	—	—	—	04	—	—	23
10. Captivity stress/heat stress	07	—	—	—	—	—	—	01	—	—	—	08
11. Injury	35	26	10	09	02	02	—	—	03	—	—	87
12. Miscellaneous	11	06	09	07	05	02	01	01	01	—	01	44
TOTAL	107	40	29	28	14	07	04	03	08	02	01	243

whereas not a single case was recorded in free living state. Out of 17 cases of tuberculosis, 16 were recorded in Chital alone, which indicates their high susceptibility to tuberculosis in captivity. It would appear that the tuberculosis in deer is directly related to the conditions of captive environment and prevalence of this disease among other animals in the zoological gardens. In many of the Zoos, cases of tuberculosis had occurred also among other zoo animals. Unfortunately, the exact typing of the tubercle bacilli associated with the disease in Chital and other zoo animals had not been done. Therefore, the type of causative organism, source and the channels of transmission of infection could not be ascertained.

Cases of Anthrax were recorded in spotted deer at Visakhapatnam Zoo (two cases), barking deer at Kohima Zoo (two cases) and Sikka Deer at Delhi Zoo (one case). Anthrax is essentially a soil borne infection. However, the infection can be transmitted through contaminated food or fodder from farms or places with a history of Anthrax. Certain birds have been found to carry spores of *Bacillus anthrax* in their alimentary tracts, and hence can disseminate the infection.

A Kashmir stag was recorded to have died of Johne's disease. Darjeeling zoo experienced an outbreak of Pasteurellosis in 1975-76 in which eight red Pandas (*Ailurus fulgens*) and one musk deer died.

An outbreak of fascioliasis was recorded at Corbett National Park in January, 1975 in which 12 chital and two hog deer died in the vicinity of the water reservoir. Fascioliasis has been reported to occur in wild animals in areas which support snail populations.

Among the non-specific diseases, pneumonia and general debility and anaemia were responsible for 10.2 per cent and 9.8 per cent of the total deaths, respectively. The cases of general debility and anaemia were recorded

in both captivity and feral state. Probably the nutrition available to the animals in forest and captivity is deficient qualitatively and or quantitatively which requires thorough investigation. Other disease conditions recorded were gastro enteritis (10 cases), dystokia (7) and Captivity stress/heat stress (8).

It has been reported that the incidence of deaths due to injuries resulting from accidents, fighting or during capture operations for treatment or managements purposes is quite high. In this survey about 35 per cent of total deaths were attributed to injuries of various origin. Frequency of these deaths can perhaps be brought down by improvement in zoo management methods by using tranquilizers.

A number of deaths due to non-specific and undetermined causes were also recorded which have been included in miscellaneous causes. The causes of death included in this category were senility (11), snake bite (2), nephritis (1), pericarditis (2), drowning (2), hepatitis (2), thrombosis (1), toxemia (1), dermatitis (2), and undetermined causes (20).

Most of the disease conditions recorded as the cause of mortality based on the post-mortem findings could be due to variety of aetiological agents. For specific aetiological diagnosis, it is highly desirable to seek laboratory support because identification of specific agents of disease will provide a more rational basis for chemotherapy and also for planning suitable measures of prevention and control in the future.

ACKNOWLEDGEMENTS

We are grateful to Dr. C. M. Singh, Director, Indian Veterinary Research Institute, Izatnagar for providing the required facilities and encouragement for undertaking the study. We are also thankful to the Chief Conser-

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vators of Forests and Chief Wild Life Wardens of Various States, Directors/Superintendents/Veterinarians of the Zoological Parks, National Parks, and Sanctuaries for providing information in respect of mortality recorded in deer.

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August 2, 1979.

REFERENCES

- BASAK, D. K., SARKAR, P., NIYOGI, M. K. AND SAMANTA, D. P. (1976) : Tuberculosis in Zoo animals in Calcutta. *Indian Vet. J.* **53** : 667-669.
- GUPTA, K. C. S. AND VERMA, N. S. (1949) : Rinderpest in wild ruminants. *Indian J. Vet. Sci.* **19** : 219-224.
- LISTON, W. G., AND SOPARKAR, M. B. (1924) : Bovine tuberculosis in India, an outbreak of tuberculosis among animals in the Bombay Zoological Gardens. *Indian J. Med. Res.* **2** : 671-80.
- PATNAIK, M. M. AND ACHARJYO, L. N. (1970) : Notes on the helminth parasites of vertebrates in Barango Zoo (Orissa). *Indian Vet. J.* **47** : 723-730.
- RAO, A. T. AND ACHARJYO, L. N. (1969) : Pathological lesions in livers of two Indian Sambar (*Cervus unicolor niger*) infected with *Paramphistomum explanatum* Creplin, 1947; Nasmark, 1937 *Gigantocotyle explanatum*. *ibid.* **46** : 916-17.
- (1972) : Further observations on fascioliasis among wild ungulates at Nandankanan Zoo. *ibid.*, **49** : 133-35.
- RAY, D. K. AND SAMANTA, D. P. (1974) : Rinderpest like syndrome in Calcutta Zoo. *ibid.*, **51** : 199-202.
- SCHALLER, G. B. (1967) : The deer and the tiger—A study of wild life in India. Univ. of Chicago Press, Chicago, pp. 54-56, 108-110, 181-182.
- SEN GUPTA, M. R. (1974) : A preliminary report on diseases and parasites of zoo animals, birds and reptiles. *Indian J. Anim. Hlth.* **13** : 15-24.
- SINGH, B. (1958) : Working plan for the Haldwani Forest Division, Western Circle, Uttar Pradesh 1956-57 to 1965-66, Allahabad. Cited by Schaller (1967), p. 55.
- SRIVASTAVA, S. (1957) : Working plan for Kalagarh Forest Division, Western Circles, Uttar Pradesh, 1955-56 to 1969-70, Allahabad. Cited by Schaller (1967), p. 55.
- TRIPATHI, S. B., ACHARJYO, L. N., RAO, A. T., PATNAIK, K. C. AND MISRA, S. K. (1971) : Survey of intestinal parasitic infestations in zoo animals and birds. *Indian J. Anim. Hlth.* **10** : 107-10.

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